PRESET AND SPECIAL FUNCTION

PRESET This key initiates a frequency calibration, initializes selected Special Functions and enters the default data values indicated in green. (To initialize Special Functions only. use 0.0 SP.) PRESET also sets the following parameters:

START FREQ = 10 MHz	FREQUENCY = 30 MHz	CALIBRATION = OFF
STOP FREQ = 1500 MHz	FREQ INCR = 20 MHz	MEAS. = NOISE FIGURE
STEP SIZE = 20 MHz	SWEEP = OFF	SMOOTHING = 1

SPECIAL FUNCTION •

This key completes a Special Function (SP) entry and activates the selected Special Function. Special Functions perform one or more of the following tasks:

a. Execute or Select Commands

1 . 2 • — Selects Measurement Mode 1.2

b. Display and Enter Data

3 . 1 • — Displays current Ext LO Frequency

3 0 0 0 ENTER — Enters new Ext LO Frequency of 3000 MHz

c. Display Information

5 . 2 • — Displays current ENR in dB

SP CODE (HP-IB CODE)

INITIALIZE SPECIAL FUNCTIONS
0.0 (CS) Initializes selected Special Functions to settings in green. However, the default data values are not entered. The existing values are not changed.

MEASUREMENT MODE SELECTION
1.0 (E0) Mode 1.0: 10 to 1500 MHz, No Ext LO
1.1 (E1) Mode 1.1: Variable-freq. Ext LO, Fixed IF
1.2 (E2) Mode 1.2: Fixed-freq. Ext LO, Variable IF (Single Sideband)
1.3 (E3) Mode 1.3: Variable-freq. Ext LO, Fixed IF (Mixer in DUT)
1.4 (E4) Mode 1.4: Fixed-freq. Ext LO, Variable IF (Mixer in DUT)

SIDEBAND FREQUENCY OFFSET
2.0 (B0) Double Sideband–No Offset
2.1 (B1) LSB ($F_{SIGNAL} < F_{LO}$)
2.2 (B2) USB ($F_{SIGNAL} > F_{LO}$)

ENTER IF AND LO FREQUENCIES
3.0 (IF) IF: Modes 1.1 and 1.3 *(30 MHz)*
3.1 (LF) LO: Modes 1.2 and 1.4 *(10000 MHz)*

CONTROL FUNCTION SELECTION
4.0 Normal Talker and Listener
4.1 Enable Ext LO Control
4.2 Talk Only

ENR AND T_{HOT} SETTINGS
(See Manual for ENR Table Entry)
5.0 (S0) Use ENR Table
5.1 (S1) Use Spot ENR
5.2 (SE) Display Current ENR in dB
5.3 (NE) Enter and Use Spot ENR *(15.2 dB)*
5.4 (TH) Enter and Use Spot T_{HOT} *(9893K)*
5.5 (SN) Enter Noise Source Identifier

T_{COLD} SETTINGS
6.0 (TC) Enter T_{COLD} *(296.5K)*

OUTPUT TO OSCILLOSCOPE
7.0 (A0) Noise Figure and Gain
7.1 (A1) Test Pattern
7.2 (A2) Noise Figure Only
7.3 (A3) Gain Only

ENTER OSCILLOSCOPE LIMITS
8.1 (NL) Noise Figure Lower Limit *(0)*
8.2 (NU) Noise Figure Upper Limit *(8)*
8.3 (GL) Gain Lower Limit *(0)*
8.4 (GU) Gain Upper Limit *(40)*

POWER MEASUREMENTS (dB Rel. to kT_0)
9.1 (N5) SOURCE Off –Uncal
9.2 (N6) SOURCE On –Uncal
9.3 (N7) SOURCE Off –Cal
9.4 (N8) SOURCE Off –Cal

NOISE FIGURE DISPLAY UNITS
10.0 (N0) F dB
10.1 (N1) F
10.2 (N2) Y dB
10.3 (N3) Y
10.4 (N4) Te K

SELECT NOISE SOURCE TEMP. UNITS FOR DATA INPUT
(Applies to 5.4, 6.0, and 34.3 SP)
11.0 (D0) K
11.1 (D1) °C
11.2 (D2) °F

DISPLAY RESOLUTION
12.0 (X0) Maximum Resolution
12.1 (X1) Less Res. on Noise Figure
12.2 (X2) Less Res. on Gain

SP CODE (HP-IB CODE)

SMOOTHING (AVERAGING)
13.0 (V0) Exponential Smoothing
13.1 (V1) Arithmetic Smoothing
13.2 (AF) Smoothing Factor *(1)*

MANUAL MEASUREMENT FUNCTIONS
14.1 (MC) Cold Meas. –SOURCE Off
14.2 (MH) Hot Meas. –SOURCE On
14.3 (CC) Cold Calibration–SOURCE Off
14.4 (CH) Hot Calibration–SOURCE On
15.0 (P0) Normal Display Mode
15.1 (P1) Display Manual Meas. Results

RECORDER FUNCTIONS
20.0 (LL) Go to Lower Left
21.0 (UR) Go to Upper Right
22.0 (A4) Plot Noise Figure
23.0 (A5) Plot Gain
24.0 (A6) Strip Chart Mode (X = Noise Figure; Y = Gain)

TRIGGER SELECTION
30.0 (T0) Free Run
30.1 (T1) Hold
30.2 (T2) Execute

FREQUENCY CALIBRATION
31.0 (Y0) Automatic
31.1 (Y1) Disable Frequency Cal
31.2 (Y2) Perform One Frequency Cal

INPUT GAIN CALIBRATION
32.0 (C0) 20, 10, and 0 dB
32.1 (C1) 10, 0, and –10dB
32.2 (C2) 0, –10, and –20 dB
32.3 (C3) –10, –20, and –30 dB

IF ATTENUATOR CALIBRATION
33.0 (IC) Use Mode 1.0 calibration setup (See Card 3) and press 33.0 SP.

LOSS COMPENSATION
34.0 (L0) Off
34.1 (L1) On
34.2 (LA) Enter dB Loss before DUT *(0 dB)*
34.3 (LT) Enter Temperature of Losses *(0K)*
34.4 (LB) Enter dB Loss after DUT *(0 dB)*

SEQUENCE FUNCTIONS
35.0 (QM) Manual
35.1 (QA) Automatic
35.2 (QS) Set *(1–9)*
35.3 (QC) Clear

HP-IB ADDRESSES
40.0 Display and Enter 8970A Address
40.1 (EA) Display and Enter Ext LO Address

EXTERNAL LO PROGRAMS
41.0 (J0) HP 8350A Sweep Oscillator
41.2 (J2) HP 8672A Syn. Sig. Generator

EXTERNAL LO COMMANDS
42.0 (AC) Auxiliary Commands
42.1 (PS) CW Prefix and Suffix
42.2 (TM) Settling Time in ms
42.3 (MN) Min Frequency in MHz
42.4 (MX) Max Frequency in MHz

HP-IB DATA OUTPUT SELECTION
43.0 (H0) NOISE FIGURE Only
43.1 (H1) Frequency (Left Display), INSERTION GAIN, NOISE FIGURE

SERVICE REQUEST
(See Status Byte, Card 2)
44.0 (Q0) Disable SRQ capability (Clears All Enabled Conditions)
44.1 (Q1) Enable Data Ready
44.2 (Q2) Enable Cal Complete
44.3 (Q3) Enable HP-IB Code Error
44.6 (Q6) Enable Instrument Error
Each condition must be enabled separately

SPECIAL FUNCTION CATALOG
50.N Refer to Card 2

For Special Functions 60 thru 99 refer to the Manual.

SPECIAL DISPLAYS

— —	Measurement overflow or Noise Figure reading greater than 23dB. See Error Code 99 below.
— — — —	Data not ready. The reserved number 90000 E + 06 is sent over HP-IB when the instrument receives a read command while this display is present in Trigger Hole mode. (90000 E + 06 is also sent when a display is blank.)

HP-IB

HP-IB OUTPUT FORMATS

HP-IB code H0 (43.0 SP): ± DDDDD E ± NN CR LF

HP-IB code H1 (43.1 SP): ± DDDDD E ± NN, ± DDDDD E ± NN, ± DDDDD E ± NN CR LF

Mantissa — Exponent

Errors:
+ 900DD E ± 06 CR LF
Error Code

Reserved Number:
+ 90000 E ± 06 CR LF
Used for the "— — — —" special display and for a blank display.

HP-IB STATUS BYTE:

Bit	8	7	6	5	4	3	2	1
Condition	0 (always)	RQS	Instru-ment Error	0 (always)	0 (always)	HP-IB Code Error	Cal Com-plete	Data Ready

SPECIAL FUNCTION CATALOG

Special Function 50.N displays the Special Function Catalog. 50.0 SP sequences thru all 6 catalog lines. 50.1 thru 50.6 SP display the specified catalog line. For example:

[5] [0] [.] [1] [●] Displays the N = 1 line:

The first displayed digit (N) is the catalog line number. Each of the other digits is the suffix of a specific Special Function as shown in the table below:

LINE NO.	SPECIAL FUNCTION PREFIXES			
1	1	2	4	5
2	10/9*	11	12	13
3	N/A	14	15	**
4	30	31	32	34
5	35	41†	43	N/A
6	SEE MANUAL			

SP code prefixes N = 1

* 0–4 = 10.0 thru 10.4 SP; 5 = 9.1 SP; 6 = 9.2 SP; 7 = 9.3 SP; 8 = 9.4 SP.

** Indicates selected analog output:
0–3 = 7.0 thru 7.3 SP; 4 = 22.0 SP; 5 = 23.0 SP; 6 = 24.0 SP.

† Indicates selected Ext LO Program:
0 = 41.0 SP (8350A); 2 = 41.2 SP (8672A); 9 = Custom Ext LO Program.

ERROR CODES

Hardware Error
(Press PRESET and check input signal. See Manual if **same** error repeats.)

E10 A/D conversion failed.
E11 A/D converter overflow.
E12 Input overflow.
E13 IF attenuator calibration failed.
E14 Cannot select proper IF or RF attenuators.
E18 Frequency calibration failed.
E80 Continuous memory failure.

Not Properly Calibrated For Corrected Measurement
(Repeat calibration, see Card 3.)

E20 Not calibrated.
E21 Current frequency is out of calibrated range.
E22 Current RF attenuator is not calibrated.
E23 Not calibrated in the current measurement and band modes.
E24 Not calibrated for the current IF (measurement modes 1.1 and 1.3).
E25 Not calibrated for the current LO frequency (measurement mode 1.2).
E26 IF attenuators not calibrated (perform Special Function 33).
E27 Overflow while calibrating.

Invalid Frequency Error
(Change frequency parameter and repeat measurement.)

E30 Start frequency is greater than stop frequency during calibration or plot. Or, the Lower Limit is greater than the Upper Limit (see Special Function 8).
E31 Number of cal. points exceeds 81.
E32 LO frequency will be out of range.
E33 IF will be out of range.
E34 DSB not allowed in meas mode 1.2.

Entry Error
(Check and repeat entry.)

E35 Entered value is out of range.
E36 Undefined special function.
E37 Paramater entry not allowed.
E38 Undefined HP-IB command.
E41 Invalid HP-IB characters.
E42 No external LO is connected when in controller mode (4.1 SP).
E43 Commands received while in Talk Only mode (4.2 SP).

Service Errors
(Do not affect SRQ or Status Byte.)

E50–79 Service related errors (see Manual).
E80 Continuous memory failure (see Hardware Errors).

Special Display Error
(Check measurement setup.)

E99 (HP-IB only) This error is sent on the HP-IB when the "— —" display is shown.

MEASUREMENT MODES

There are 3 groups of Measurement Modes

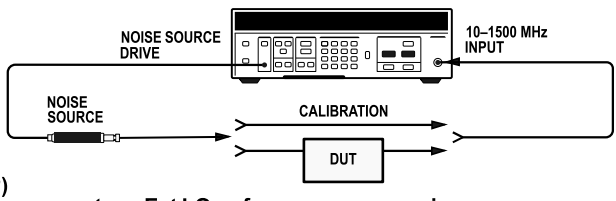
I. Mode 1.0 is used from 10 to 1500 MHz, no Ext LO or frequency conversion.
II. Modes 1.1 and 1.3 are used with a variable-frequency Ext LO and a fixed IF.
III. Modes 1.2 and 1.4 are used with a fixed-frequency Ext LO and a variable IF.

The external equipment is similar for Modes 1.1 and 1.2 or 1.3 and 1.4 (see figures below).

MINIMUM REQUIREMENTS for Modes 1.1 and 1.3 when the HP 8970A is the controller:

a. HP-IB cable connected between 8970A and the Ext LO.
b. Ext LO control selected (4.1 SP).
c. Ext LO address correct (40.1 SP).
d. An Ext LO program selected (For example, 41.0 or 41.2 SP).

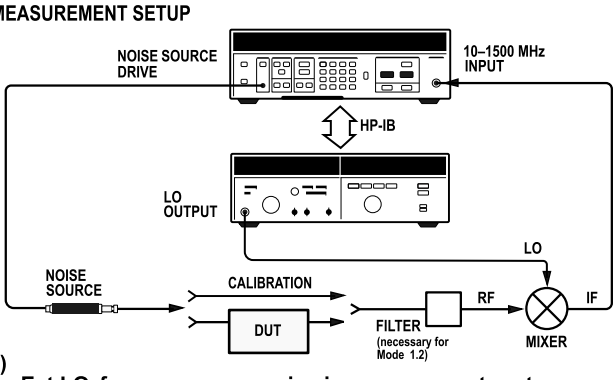
CALIBRATION AND MEASUREMENT SETUP (MODE 1.0)



MODE 1.0 (1.0 SP)
10–1500 MHz measurement, no Ext LO or frequency conversion.

a. Press 1.0 SP.
b. Set frequency parameters.
c. Calibrate as shown.
d. Insert device under test (DUT) and measure.

CALIBRATION AND MEASUREMENT SETUP (MODE 1.1 AND 1.2)



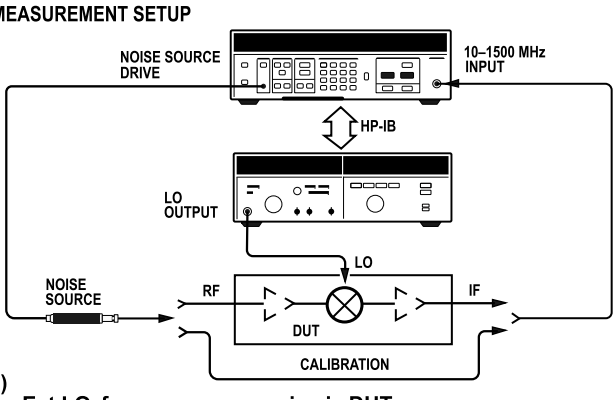
MODE 1.1 (1.1 SP)
Variable-frequency Ext LO, frequency conversion in measurement system but not in DUT.

a. Verify minimum requirements (see above).
b. Press 1.1 SP.
c. Set frequency parameters (including fixed IF, 3.0 SP).
d. Calibrate as shown.
e. Insert DUT and measure.

MODE 1.2 (1.2 SP)
Fixed-frequency Ext LO, single sideband, frequency conversion in measurement system but not in DUT

a. Select single sideband offset (2.1 or 2.2 SP).
b. Press 1.2 SP (left display shows E33 until step c. is performed).
c. Set frequency parameters (including fixed LO Frequency, 3.1 SP).
d. Calibrate as shown (external filtering is required).
e. Insert DUT and measure.

CALIBRATION AND MEASUREMENT SETUP (MODE 1.3 AND 1.4)



MODE 1.3 (1.3 SP)
Variable-frequency Ext LO, frequency conversion in DUT (for testing mixer or receiver).

a. Verify minimum requirements (see above).
b. Press 1.3 SP.
c. Set frequency paramaters (including fixed IF, 3.0 SP).
d. Calibrate as shown.
e. Insert DUT and measure.

MODE 1.4 (1.4 SP)
Fixed-frequency Ext LO, variable IF, frequency conversion in DUT (for testing mixer or receiver).

a. Set frequency parameters (including fixed LO Frequency, 3.1 SP).
b. Press 1.4 SP.
c. Calibrate as shown.
d. Insert DUT and measure.
e. Left display shows IF frequency.